CHROMOSOME NUMBERS IN THE GENUS AMSINCKIA

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The borage genus *Amsinckia*, particularly the group centered about *A. intermedia* Fisch. & Mey., is still a notable taxonomic enigma. I. M. Johnston (1924) opined that "from its exceptional and baffling complexity there seems little hope that students can ever arrive at agreement regarding its treatment." W. Suksdorf (1931) felt compelled to propose some 200 new specific names in the genus, when less than a dozen had been recognized previously; many of the quantitative characters he employed are, however, of doubtful significance. Johnston (1935) has clarified the nomenclature of the genus helpfully, but still describes the *intermedia* group as "variable and bewildering" and "polymorphous."

It was hoped that cytological and genetic information would better characterize natural groups and relationships in *Amsinckia;* accordingly, chromosome counts and a greenhouse program of hybridization were undertaken. The cytological results obtained to date are reported here (table I.). With patience, countable meiotic divisions can be had with aceto-carmine or -orcein squashes of pollen mother cells; living buds or buds previously fixed in Carnoy's chloroform-alcohol-acetic acid mixture are satisfactory. Mother cells and chromosomes are reasonably large. The stage of division best suited to counting varies somewhat with different species; in those with higher chromosome numbers, second metaphase, where the chromosomes are very contracted, seems to be the only feasible stage. The principal difficulty is an inordinate tendency of the cytoplasm to stain and darken; this can be overcome by frequent, repeated destaining with 45 per cent acetic acid after the initial staining with acetocarmine.

There has been almost no investigation of the cytology of this group heretofore. The only report known to the author is that of Strey (1931), who used root tip sections of two specimens identified by him as *A. intermedia* and *A. angustifolia* Lehm. He figured and described the diploid chromosome number of each of these as 32, and believed that a third specimen, *A. lycopsoides* Lehm., also had 2n=32, but could not figure it. Specimens in this last species and in *A. intermedia* are here reported as n=15. One would note that in both of the figures he provided, Strey indicated doubt as to whether certain places, which he counted as two chromosomes, were not actually single ones; the appearance of the figures is such that they might be counted as 2n=30. The number n=16 has not yet been found by us in this group.

It would seem that no evident base number or simple arithmetical scheme is common to the chromosome numbers found thus far among the populations of *Amsinckia* studied. Though

Table I. Chromosome Counts in Amsinckia.

Species	Chromosome number	Collection number	Locality
A. tessellata Gray	n=12	*Reid Moran 3373*	Tehachapi Range, Kern County, Calif.
A. Douglasiana A. DC.	n=12	*Kamb K-88*	Grown from seed, *Kamb 1612*: east of Paso Robles, San Luis Obispo County, Calif.
A. spectabilis F. & M.	n=5	*Kamb K-87*	Grown from seed, *V. Grant 7910*: Pt. Reyes, Marin County, Calif.
A. spectabilis F. & M.	n=5	*C. R. Bell & M. Birdsey*	Pt. Reyes, Marin County, Calif. (15 April 1951)
A. retrorsa Suksd.	n=8	*C. R. Bell 955*	Sierra foothills east of Farmington, San Joaquin County, Calif.
A. retrorsa Suksd.	n=8	*Kamb 1707*	Cache Creek, Colusa County, Calif.
A. lycopsoides Lehm.	n=15	*Kamb 1984*	Near Stockton, San Joaquin County, Calif.
A. intermedia F. & M.	n=15	*Kamb 1983*	Near Stockton, San Joaquin County, Calif.
A. intermedia F. & M.	n=19	*C. R. Bell 954*	Sierra foothills east of Farmington, San Joaquin County, Calif.
A. Eastwoodae Macbr.	n=12	*C. R. Bell 953*	Sierra foothills east of Farmington, San Joaquin County, Calif.
A. inepta Macbr.	n=18	*Kamb K-66*	Grown from seed, *Reid Moran 3053*: San Martin Island, Baja California, Mexico.

all the more interesting on this account, the cytological investigations seem mostly to have created problems rather than solved them. They have shown, however, that populations and species in *Amsinckia* may differ in a more fundamental way than the description "polymorphic" would lead one to believe.

The numbers n=12 in the *A. tessellata* group, n=5 in *A. spectabilis,* and n=8 in *A. retrorsa* promise to be distinctive. An intensive program of counts is anticipated in an attempt to understand better the *A. intermedia* group.

Hybridization experiments have shown that, while it is not possible to cross certain species, in other cases hybrids can be obtained between plants of different chromosome number. It is hoped that the cytological behavior of such hybrids, several of which are being grown in the department greenhouse, will shed light on the significance of the chromosome differences we have found.

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REVIEWS

A Flora of Santa Barbara, an Annotated Catalogue of the Native and Naturalized Plants of Santa Barbara, California, and Vicinity. By Clifton F. Smith. 100 pp., 6 black and white photographs. 1952. Santa Barbara Botanic Garden. $1.50.

Because of the unique situation of Santa Barbara on California's somewhat nebulous Mason-Dixon line where northern and southern California meet, this annotated list is of far more interest than it might be solely on the bases of its relative completeness, the broad range of habitats represented, and the care with which the author has handled the binomials in the systematic list. Furthermore, Santa Barbara has been a favored collecting area for more than a century, and hence the source of type material collected by Douglas, Nuttall, Gambel, Parry, Brewer, Torrey, Rothrock, Plummer, Cooper, Yates, Elmer, and many others. Their activities in this area are briefly chronicled by Smith. No similar local flora is available for any other section of this boundary area, although it is understood that similar efforts are in progress for all or parts of San Luis Obispo and Ventura counties.